# Relationships between Perceived Stress, Coping Behavior and Cortisol Secretion in Women with High and Low Levels of Internalized Racism

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*Aim:* It is hypothesized that a chronic defeat response to social or environmental stressors increases the likelihood of dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis with dysregulation of cortisol, accumulation of abdominal fat and development of glucose intolerance. Recent studies show that African-Caribbean women who have a high level of internalized racism (INR) are at increased risk for abdominal obesity and glucose intolerance. The aim of the current study was to determine if African-Caribbean women with high and low INR differ in their levels of perceived stress and defeat coping style, and in the relationship of these factors to cortisol secretion.

*Methods:* On the island of Dominica, information on perceived stress and coping style was collected from age- and body mass index-matched samples of nondiabetic women aged 25–60 with high (n=27) and low (n=26) INR. Cortisol levels for each participant were determined from saliva specimens collected at 8:30 am and 10:30 pm.

*Results:* A higher mean perceived stress score (PSS) and greater tendency to use "restraint," "denial" and "behavioral disengagement" (defeated) coping (BDC) styles were found among women with high INR compared to those with low INR. In the combined sample, PSS and BDC were significantly correlated with an indicator of dysregulation of cortisol. However, in group-specific analyses, adjusting for age and education, these correlations remained significant only among women with high INR.

*Conclusion:* These findings support the view that high perceived stress and defeated coping style may be factors that link high INR to dysregulation of cortisol and, perhaps, also to greater risk of metabolic abnormalities.

**Key words:** internalized racism ■ perceived stress ■ coping ■ cortisol

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There is growing recognition of the importance of social and cultural factors in determining the global variation in risk of chronic diseases, like type-2 diabetes mellitus.[1] Internalized racism (INR), measured as the extent to which blacks agree with racist stereotypes about blacks, is one sociocultural factor that has been investigated as a possible risk factor for psychological distress and poor lifestyle behaviors among African Americans.[2-4] More recent investigations among U.S. Caribbean blacks and those of non-U.S. background have shown that a high level of INR is associated with increased psychological distress (anxiety, hostility), abdominal obesity and glucose intolerance.[5-7] However, the etiological pathway(s) that link high levels of INR to greater metabolic health risk remain unclear.

The recent work of Per Björntorp and colleagues[8,9] relating stress-mediated dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis to abdominal obesity and glucose intolerance in humans suggests a possible psychobiological pathway that may link a high level of INR to adverse metabolic outcomes. Early research in this area by Henry and Ely[10] identified two principal types of reactions to stress in mice exposed to competition. One reaction was characterized by elevation of heart rate and blood pressure in the period of stress and return to the steady state when the stress was diminished. A second "defeated" type of reaction occurred in mice that were unable to compete successfully. These animals exhibited submissive behavior, helplessness and elevated cortisol secretion. Shively et al.[11] exposed cynomolgus monkeys to social stressors and found that those primates who exhibited a chronic defeated type reaction had more depression and developed abdominal obesity and other metabolic abnormalities, including glucose intolerance. Björntorp hypothesized that a chronic defeat response in humans may be the factor that initiates the cascade of metabolic abnormalities leading to HPA-axis dysfunction with dysregulation of

cortisol, increased abdominal obesity and metabolic abnormalities like glucose intolerance.[8]

In the context of Björntorp's hypothesis, the current investigators have previously suggested[6] that the significant association of a high level of INR to abdominal obesity and glucose intolerance in African-Caribbean women[5-7] may be due to a greater tendency toward defeated style coping and dysregulation of cortisol among those with high INR. In addition, it has been shown that a high level of chronic perceived stress is associated with HPA-axis dysfunction.[12] Therefore, it is possible that individuals with high INR are also more likely to have higher levels of perceived stress.

This report describes the results of a study that utilized samples of African-Caribbean women with high and low levels of INR to determine if those with high INR report higher levels of perceived stress and greater use of defeat coping style, and furthermore whether perceived stress and defeat coping style are more likely to show significant relationships to dysregulation of cortisol in African-Caribbean women with high INR compared to those with low INR.

## MATERIALS AND METHODS

This study was conducted between June and August 2003 and included nondiabetic black women between the ages of 25 and 60 who resided on the Caribbean island of Dominica. The study subjects were recruited from among a population-based sample of 244 women who participated in the Dominica Obesity and Diabetes Risk Survey (DODARS) in which information on INR had been collected.[6] The participants in the DODARS had been recruited at random from households that were chosen by sampling a proportion of all neighborhoods within the city of Roseau on the island of Dominica. The participation rate for the DODARS study was 77%. For the current assessment, the distribution of INR scores from the DODARS participants was examined, and a random sample of 27 nondiabetic women whose scores were in the upper third of the distribution (high INR) was recruited. A control sample of 26 nondiabetic women who were frequency matched by age and BMI to the high-INR group was also recruited from among those DODARS participants whose INR scores were in the lower third of the distribution (low INR). All participants signed consent forms that were approved by the Ministry of Health of Dominica.

Data on study participants were gathered at the research laboratory of the Dominica Diabetic Association in the city of Roseau. Information on INR was based on an interview of participants using the Nadanolitization (NAD) scale.[13] The NAD scale is a 22-item questionnaire that assesses INR as the degree to which blacks agree with racist stereotypes that blacks are "physically gifted" and "mentally defective." From each participant in the current study, information on perceived stress was collected using the Cohen's 10-item Perceived Stress Scale (PSS).[14] Interviews were also conducted to collect information on coping behaviors using the 53-item COPE Inventory of Carver, Scheier and Weintraub.[15] The COPE Inventory is a multidimensional questionnaire that has 14 subscales: five subscales measure aspects of problem-focused coping (active coping, planning, suppression of competing activities, restraint coping, and seeking of instrumental social support); five subscales measure aspects of emo-

**Table 1. Adjusted* Characteristics of Women with High and Low Levels of Internalized Racism (INR)**

| | Low INR | High INR | P Value |
|---|---|---|---|
| N | 26 | 27 | — |
| INR* | 25.8 ± 13.4 | 48.3 ± 17.2 | <0.0001 |
| Age (years)* | 36.9 ± 9.2 | 38.3 ± 9.3 | 0.617 |
| Education ≥ secondary* school (%) | 46.1 | 26.0 | 0.123 |
| BMI (Kg/m$^2$)† | 29.5 (26-8-32.2) | 31.1 (28.5–33.8) | 0.395 |
| Waist circumference (cm)† | 91.1 (85.6–96.5) | 96.1 (90.8–101.3) | 0.202 |
| Perceived stress score† | 28.1 (26.0-30.2) | 31.4 (29.3–33.7) | 0.029 |
| Δ-ME†‡ | 0.246(0.182–0.310) | 0.175(0.112–0.237) | 0.122 |

* Values are means ± standard deviations (SD), percent (%) or means with 95% confidence intervals adjusted for age and education;
‡ Δ-ME: difference between morning and evening salivary cortisol levels.

tion-focus coping (seeking emotional social support, positive reinterpretation, acceptance, denial, turning to religion); and four subscales measure more negative coping strategies (venting of emotions, behavioral disengagement, mental disengagement, alcohol/drug use). Questions in each subscale were assessed on a four-point Likert scale ranging from 1 ("I don't do this at all") to 4 ("I do this a lot").

Anthropometric measurements performed on each participant included weight, height and waist circumference. Weight was measured on a balance-beam scale with participants in light clothing and no shoes. Height was measured with a wall-mounted ruler. The body mass index for each participant was calculated as weight in kilograms (kg) divided by height in meters squared ($kg/m^2$). Waist circumference was measured at the umbilicus using standard procedures.[16] Study personnel who preformed all anthropometric measurements were trained and certified in the use of techniques employed by the University of Pittsburgh, Obesity and Nutrition Center, Pittsburgh, PA.

To assess dysregulation of cortisol in a manner consistent with Björntorp's hypothesis, the difference between morning and evening cortisol measurements (Δ-ME) was determined for each participant. Normal function of the HPA axis is characterized by a diurnal rhythm in cortisol secretion, with peak levels in the morning followed by lower levels into evening.[17] When stress signals are prolonged, a dysfunction of the HPA axis occurs with the first sign being delayed down regulation, with poststimulation cortisol remaining above basal levels for longer periods.[18] With continued dysfunction, the normal rhythm of high-HPA-axis activity in the morning is disrupted, and morning cortisol levels are lower, resulting in a flatter diurnal curve.[19] The concentration of cortisol in saliva mirrors the amount of free active cortisol in serum,[20] which allows for assessment of the diurnal rhythm using saliva. Thus, in the current study, saliva samples were collected at 8:30 am, at the time cortisol levels would normally peak, and again at 10:30 pm, when circulating levels of cortisol are low. Individuals with more HPA-axis dysfunction would be expected to have a smaller value for Δ-ME. The saliva specimens were shipped on dry ice by express-mail service to a reference laboratory where they were measured for cortisol.

## STATISTICAL ANALYSIS

All statistical assessments were performed using Statistical Analysis System (SAS) software.[21] Mean values for continuous variables were compared using the Student's t-test and analysis of variance. Wilcoxon rank sums were used to assess differences in means for ordinal data. The Chi-square ($\chi^2$) or Fisher's Exact Test was used to compare the frequency of dichotomous variables. Correlation analyses were used to examine the interrelationships between variables and, when appropriate, partial correlations were used to examine the extent to which a given variable accounted for the significant relationship between two other variables (for example, partial correlations were used to determine if the relationship of perceived stress to Δ-ME was confounded by age).

## RESULTS

A comparison of the characteristics of the women in the high and low INR groups is presented in Table 1. There was no significant difference between the groups in mean age. A larger number of individuals

**Table 2. Comparison of Mean Scores* for Coping Strategies between Black Women with High and Low Levels of INR**

| Coping Strategy | Low INR (n=26) | High INR (n=27) | P Value |
|---|---|---|---|
| Active | 10.9 ± 2.9 | 11.0 ± 2.7 | 0.992 |
| Planning | 12.2 ± 2.3 | 12.2 ± 2.4 | 0.992 |
| Suppression of competing activities | 10.4 ± 2.3 | 10.7 ± 2.7 | 0.789 |
| Restraint coping | 7.9 ± 3.0 | 10.0 ± 2.8 | 0.017 |
| Seeking social support for instrumental reasons | 10.0 ± 3.3 | 10.7 ± 4.2 | 0.488 |
| Seeking social support for emotional reasons | 9.5 ± 3.4 | 8.5 ± 3.9 | 0.419 |
| Positive reinterpretation and growth | 13.2 ± 2.6 | 12.2 ± 2.7 | 0.141 |
| Acceptance | 11.6 ± 3.0 | 11.8 ± 3.3 | 0.837 |
| Turning to religion | 14.8 ± 1.8 | 14.4 ± 2.2 | 0.741 |
| Focus on venting of emotions | 9.7 ± 3.1 | 9.8 ± 2.7 | 0.907 |
| Denial | 6.7 ± 3.3 | 8.6 ± 3.7 | 0.039 |
| Behavioral disengagement | 7.3 ± 2.9 | 8.8 ± 3.2 | 0.066 |
| Mental disengagement | 8.6 ± 2.8 | 9.3 ± 3.2 | 0.419 |
| Alcohol/drug use | 1.15 ± 0.61 | 1.22 ± 0.57 | 0.447 |

* Values are means ± standard deviations.

in the low-INR group were secondary school graduates, but this difference was not statistically significant. There was no significant difference in the age- and education- adjusted mean values for BMI and waist circumference between the groups, but perceived stress score (PSS) was significantly higher among those with high INR. The women with high INR had a lower mean Δ-ME, but this difference was not statistically significant.

Table 2 shows the results of analyses to determine whether coping strategies differed between women with high and low INR. The results of these comparisons revealed that women with high INR reported significantly higher levels of "restraint coping" and "denial coping." Higher levels of behavioral disengagement coping (BDC) among women with high INR also approached significance.

The results of correlation analyses that were conducted using the combined sample of study participants to examine the relationship of Δ-ME to INR score, PSS, coping style, BMI and waist circumference are shown in Table 3. These data indicate that Δ-ME was significantly and inversely correlated with mean INR score, PSS and waist circumference. BMI was not significantly correlated with Δ-ME. Among the coping strategies, only BDC showed a marginal significant inverse correlation with Δ-ME in the combined sample. In other analyses that examined the relationship of coping style to PSS, only "restraint coping" was significantly correlated with PSS ($r=0.38$, $p=0.006$).

Table 4 shows separate analyses among women with high and low INR in which simple and partial correlation analyses were used to examine the interrelationships of PSS, BDC and Δ-ME while adjusting for age and educational level. Among women with high INR, both PSS and BDC remained significantly and inversely correlated with Δ-ME after adjusting for both age and education. Neither PSS nor BDC was significantly correlated to Δ-ME among women with low INR. Among women with high INR, the significant relationship of PSS to Δ-ME persisted after adjusting for BDC. However, after adjusting for PSS, the relationship of BDC to Δ-ME became nonsignificant.

## DISCUSSION

In the current nested case-control study, women with a high level of INR reported higher levels of perceived stress compared to women with low levels of INR. This result is consistent with findings from the parent sample,[6] other Caribbean populations[5,7] and African-American women[2] in which other measures of psychological distress were significantly related to INR. One factor that might account for the higher level of perceived stress among those with high INR is lower socioeconomic status. In a study of African-American women,[22] lower educational attainment was a significant predictor of perceived stress. In the current study, there was a preponderance of persons with low educational achievement in the high-INR group. However, adjustment for educational level did not eliminate the significant difference in mean PSS between the two INR groups.

It has been shown that individuals with a dysfunctional HPA axis have a flatter diurnal cortisol curve,[23] with a smaller difference between morning (peak) and evening cortisol levels. If, as hypothesized,[6] individuals with high INR have more HPA-axis dysfunction then Δ-ME should be significantly lower among those with high INR. However, in the current study, the difference in mean Δ-ME between women with high and low INR did not achieve statistical significance, although values were lower for women with high INR, and INR correlated significantly with Δ-ME in the overall sample. One reason for the failure to find a significant difference in mean Δ-ME between the two groups may be lack of statistical power because of the small sample sizes. Another possible reason is the fact that the two

**Table 3. Spearman Correlation Coefficients Relating INR Score, Perceived Stress Score (PSS), Coping Style and Anthropometric Measurements to the Difference between Morning and Evening Cortisol Levels (Δ-ME ) in the Combined Study Sample (n=53)**

| | R for Δ-ME | P Value |
|---|---|---|
| Age | -0.01 | 0.936 |
| Education | 0.04 | 0.758 |
| INR score | -0.27 | 0.045 |
| PSS | -0.32 | 0.022 |
| Denial coping | -0.02 | 0.549 |
| Restraint coping | -0.08 | 0.881 |
| Behavioral disengagement coping | -0.27 | 0.051 |
| BMI ($Kg/m^2$) | -0.16 | 0.226 |
| Waist circumference (cm) | -0.34 | 0.012 |

groups were matched on adiposity and did not differ significantly in their mean values for BMI and waist circumference. Studies have been consistent in reporting that individuals with HPA-axis dysfunction have higher levels of abdominal obesity (assessed by waist circumference or waist-hip ratio).[24,25] In the parent population from which the women were selected, those with high INR had significantly larger waist conference.[6]

Coping involves the use of problem-solving when the demands of a situation require an adaptive response.[26] The comparison of coping strategies between women with high and low INR showed that those with a high level of INR were more likely to use passive coping styles, such as "restraint coping, denial coping and BDC." Greater use of "restraint coping" and "denial coping" among women with high INR suggests, respectfully, that these women were more likely to either refrain from taking action to resolve a stressful situation or cope with a stressor by refusing to believe that they were being affected by it. Women who tended to use BDC were more likely to adopt a defeated position when faced with a challenging obstacle to their achievement of some goal. It has been hypothesized that stress will result when an individual's perception of the demands of a situation outweigh his/her ability to cope.[27] The greater use of passive coping styles in the women with high INR might indicate a greater stress burden on the HPA axis of these women.

In the combined sample of women, significant inverse correlations of waist circumference, PSS and BDC with Δ-ME were observed. These findings are consistent with results from other studies of women[24,28] and men[29] in which higher levels of psychological distress and waist circumference are closely associated with more HPA-axis dysfunction and dysregulation of cortisol. The observation that "restraint coping" was positively and significantly correlated to PSS in the current study is also consistent with the results from a study by Stancil et al.,[22] in which African-American women who reported greater use of a passive restraint coping style (characterized by accepting a difficult situation and not talking about it to anyone) had higher levels of perceived stress. It is noteworthy that BDC was the only coping style that was significantly correlated with Δ-ME in the overall sample. This observation may indicate that, among the coping styles assessed by the COPE inventory, behavioral disengagement more closely approximates the defeated type reaction to stressors observed in experimental studies.[10,11]

In the current study, group-specific analyses showed that the significant associations of PSS and BDC with Δ-ME persisted only for women with high INR, even after adjustment for age and education. It was also noted that adjustment for BDC had no effect on the significance of the relationship between PSS with Δ-ME. Conversely, adjustment for PSS eliminated the significant relationship of BDC with Δ-ME, although the correlation coefficient between the latter two variables remained modest. These results may indicate that there are interactions among INR, PSS and BDC that influence Δ-ME in the current population of African-Caribbean women. However, assessment of these interactions requires larger sample sizes than those available in the current study. Additional studies are needed to better understand the interrelationships between INR, perceived stress, BDC and Δ-ME in African-Caribbean women.

In a study of the relationship of socioeconomic status and HPA-axis function, Rosmond and Björntorp[30] observed that changes in HPA-axis function were more pronounced, with longer duration of low socioeconomic status, suggesting that metabolic abnormalities develop over time with continued exposure to an environment that affects cortisol secretion. It is likely that a high level of INR over an extended period of time is needed for the significant relation-

**Table 4. Simple and Partial Spearman Correlation Coefficients Relating Perceived Stress Score (PSS) and Behavioral Disengagement Coping (BDC) to Δ-ME† in Women with High (n=27) and Low (n=26) Levels of INR**

| | Low INR | | High INR | |
|---|---|---|---|---|
| **Correlation with** | **PSS** | **BDC** | **PSS** | **BDC** |
| Δ-ME | -0.01 | -0.08 | -0.54** | -0.43* |
| Δ-ME, adjusted for age | -0.02 | -0.07 | -0.53** | -0.42* |
| Δ-ME, adjusted for education | 0.06 | -0.10 | -0.53** | -0.42* |
| Δ-ME, adjusted for age and education | 0.06 | -0.09 | -0.52** | -0.41* |
| Δ-ME, adjusted for BDC | -0.01 | — | -0.51* | — |
| Δ-ME, adjusted for PSS | — | -0.08 | — | -0.31 |

† Δ-ME: difference between morning and evening cortisol level; Values are significant at * $p<0.05$; ** $p<0.005$

ships among perceived stress, BDC and Δ-ME to occur. However, it is unclear at which stage of the lifecycle these significant relationships are first manifested. A high level of INR (in particular, the belief that one is intellectually inferior) that begins in childhood and extends into adulthood might contribute to less educational achievement and lower socioeconomic status together with greater likelihood of adopting passive coping strategies in the face of socioeconomic disadvantage. Under these circumstances, both mental and physical health would be adversely affected. Studies to understand the time-dependent effects of INR on the socioeconomic, mental and physical health of blacks are needed.

There are limitations to this study. The study is cross-sectional in design and, consequently, the results cannot be interpreted as causal. Menopausal status, which was not assessed in the current study, is known to influence abdominal adiposity. However, the women with high and low INR were matched on age and anthropometric measures of adiposity. Any differences between the groups that might exist in the frequency of women with or without menopause would be expected to be small and not have a significant effect on the results of the study. Additionally, the sample size is small and these preliminary findings should be confirmed on a larger sample.

In summary, the current study examined the relationships among perceived stress, coping behavior and cortisol secretion in African-Caribbean women with high and low levels of INR. The results of these assessments show relationships between the variables that are consistent with the hypothesis that a high level of INR is associated with adverse effects on mental and physical health. This study demonstrates for the first time that passive coping styles associated with a high level of INR are related to higher perceived stress and dysregulation of cortisol. Limitations in study design do not permit generalization of these findings to African-American women. However, given that there is likely more societal racism in the United States and that an estimated 33% of African Americans in some communities may have high levels of INR,[31] studies to replicate these findings in African Americans are warranted.

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